2001 NDIA Joint Services Small Arms Symposium

Non-Lethal Airburst Munition(s) for Objective Individual Combat Weapon

15 August 2001

US Army, TACOM
Armament Research, Development and Engineering Center

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Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
15Aug2001	N/A	-

Title and Subtitle Non-Lethal Airburst Munition(s) for Objective Individual Combat Weapon	**Contract Number**
	Grant Number
	Program Element Number
Author(s) Sanchez, Camilo A.	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) US Army TACOM-ARDEC AMSTA-AR-QAC-S, Bldg 65 Picatinny Arsenal NJ 07806-5000	**Performing Organization Report Number**
Sponsoring/Monitoring Agency Name(s) and Address(es) NDIA (National Defense Industrial Association) 211 Wilson Blvd, STE. 400 Arlington, VA 22201-3061	**Sponsor/Monitor's Acronym(s)**
	Sponsor/Monitor's Report Number(s)

Distribution/Availability Statement
Approved for public release, distribution unlimited

Supplementary Notes
Proceedings from the 2001 Joint Services Small Arms Symposium, Exhibition & Firing Demonstration 13-16 August 2001 Sponsored by NDIA, The original document contains color images.

Abstract

Subject Terms

Report Classification unclassified	**Classification of this page** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** UU

Number of Pages
18

Program Description

Program Name: NL AB Munitions for OICW

Concept:

• Exploit the ability of the OICW to airburst munitions at a precise location in space to emplace or employ NL concepts.

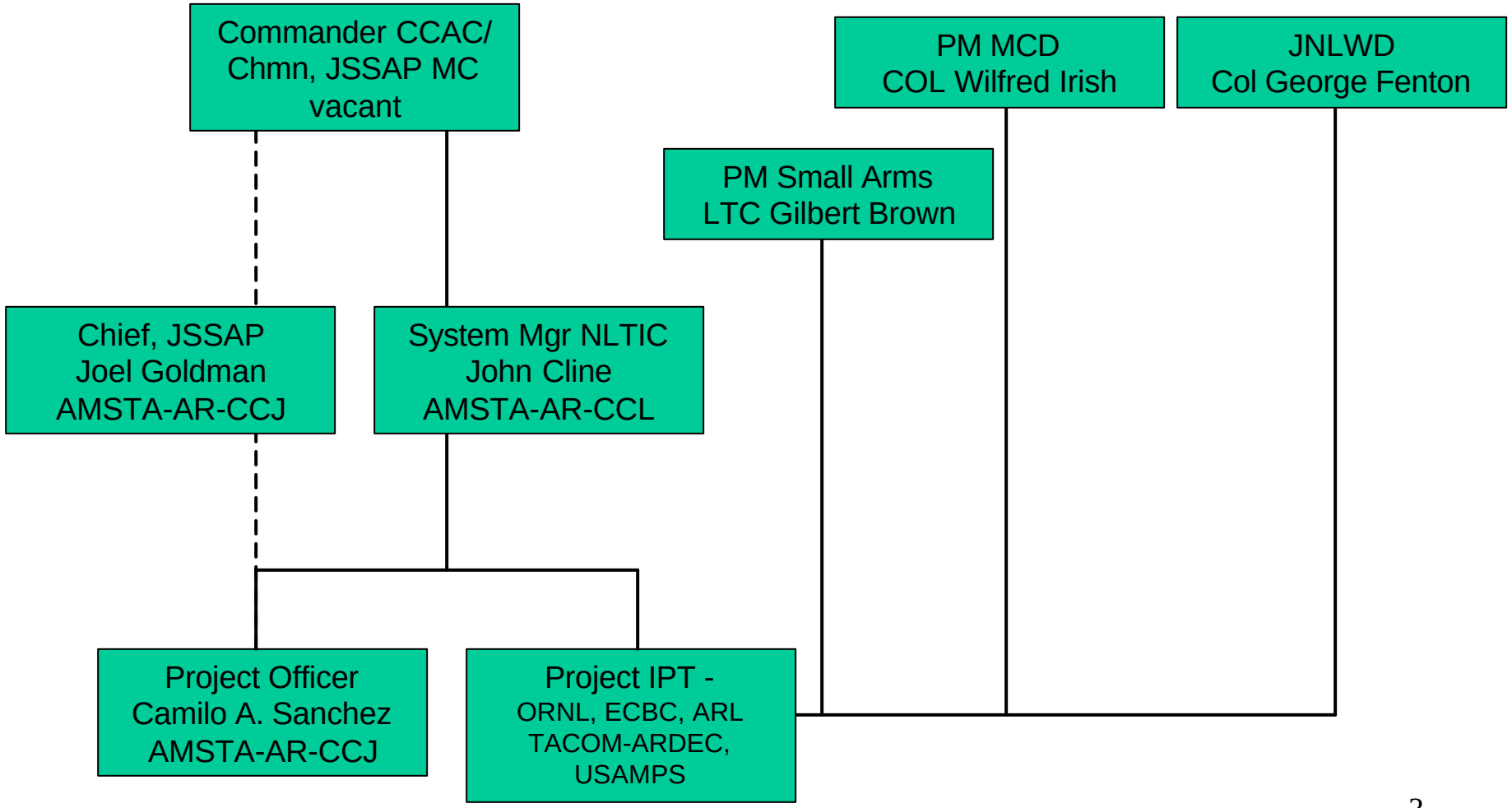
• Concepts that will be capable of dispersing or deploying Liquids, Aerosols, Powders & Objects will be designed, modeled and demonstrated.

• Payload analysis of NL RCA payloads will be conducted

Possible Payloads:

- **Counter Personnel**
  - Markers
  - Taggants
  - Incapacitants
  - Malodorants
  - OC/RCA
  - Stingball Grenade
  - Fuzed Blunt Injury
- **Counter Materiel**
  - Markers
  - Taggants
  - Anti-traction

Organizational Structure



Requirements

Objectives Proposed by Joint Non-Lethal Weapons Requirements Integration Group (RIG) – 26 April 2000

RANGE	5-1000 meters
TARGET ORIENTATION	Defilade, Open, Covered, Enclosed
PAYLOAD	Liquid, Powder, Aerosol, Objects
ACCURACY	Point =550, Area=1000 With PH given for certain radius.
OTHER	• Scalability to other size rounds • All weather • Gun/Ammo interface identification • Operate same as lethal round

Measure of MS A Success:

	Criteria	Threshold	Goal
1	Dispense Payload:	250m	5m-1000m
2	Technology Readiness Level (TRL)	4*	5

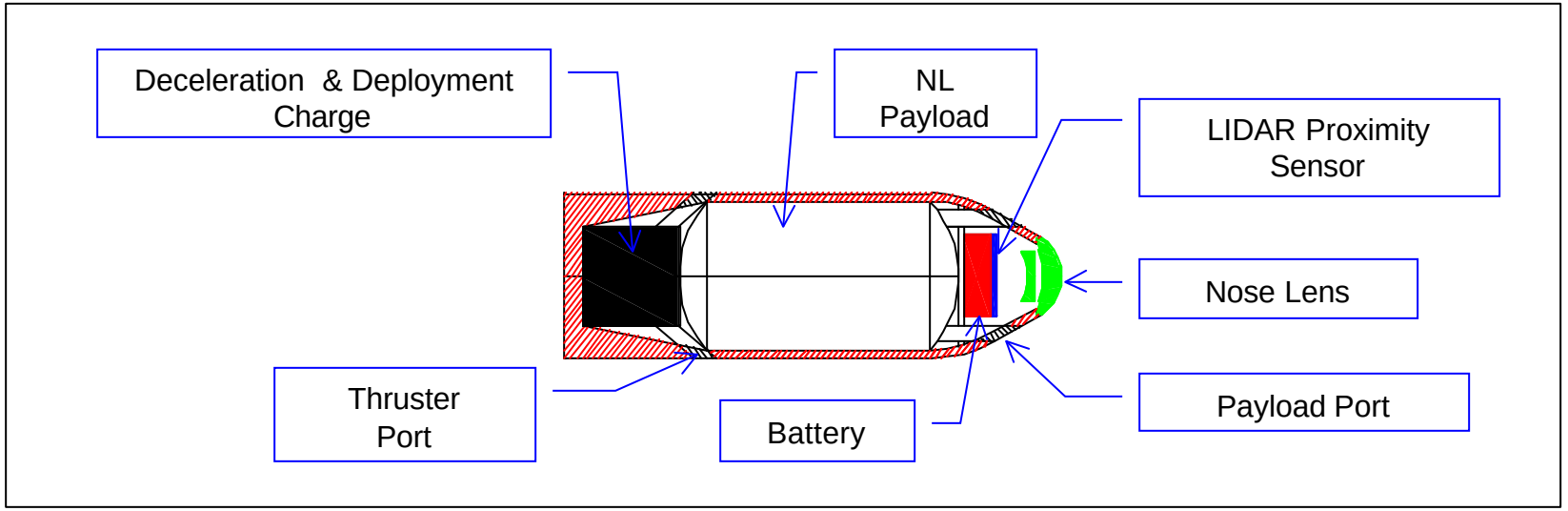
* Component and/or breadboard validation in a relevant environment

Preliminary Risks & Challenges

- **Potential lethal / injurious effects from projectile, airburst and parasitic mass**
- **20mm payload / volume limitations**
- Potential major weapon design changes in PD&RR
- MEMS S&A and Micro Energetic Initiator (MEI) development
- Burst point precision

OBJECTIVE INDIVIDUAL COMBAT WEAPON (OICW) AIRBURST NON LETHAL MUNITION PROGRAM

Integrated Proximity Sensor w/ Reverse Thrust Concept



• LIDAR proximity sensor (LPS) and controlled terminal deceleration for the deployment of an incapacitating agent.

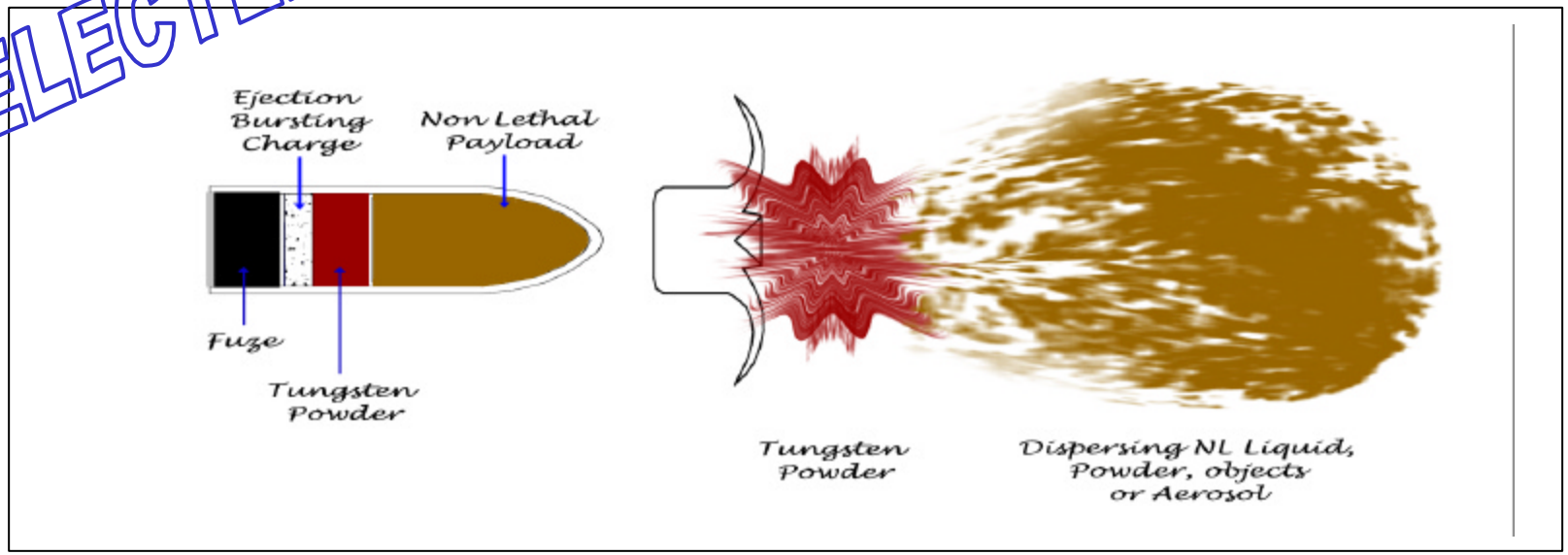
•LPS located in the nose of the shell will initiate payload deployment at a pre-determined range from the target.

• Array of variable force-reversing thrusters will fire to decelerate the projectile to a non-lethal velocity and simultaneously release the payload. The force of the reversing thrusters may be adjusted to match the changing projectile velocity. In addition, the ejection of the NL payload will be used to provide a portion of the deceleration force.

OBJECTIVE INDIVIDUAL COMBAT WEAPON (OICW)
AIRBURST NON LETHAL MUNITION PROGRAM

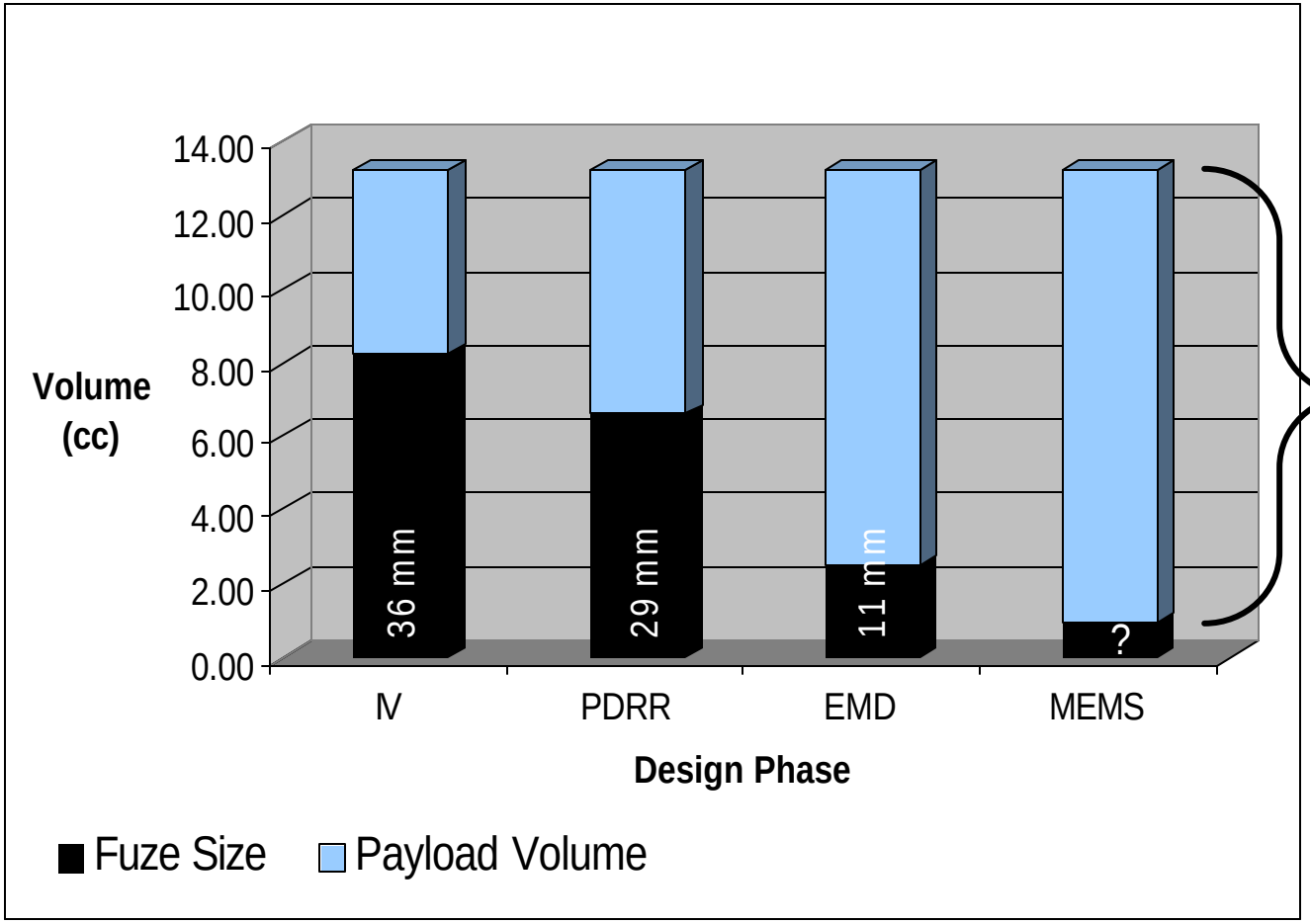
SELECTED

Controlled Residual Kinetic Energy Concept



- The bursting charge projects the non-lethal payload of liquids/powders/aerosols/solids and a dense powder mass.
- The forward momentum of the non-lethal payload and dense powder mass reduce the forward momentum and kinetic energy of the residual projectile to a non-lethal level (“Davis Gun concept”).
- The high aerodynamic drag of the dense powder allows the kinetic energy of the dense powder payload to be rapidly dissipated.
- The aerodynamic characteristics of the non-lethal payload and the burst point from the target provide the non-lethal delivery of the non-lethal payload.
- Projectile mass, velocity, recoil impulse and trajectory are matched to the lethal projectile for Fire Control compatibility and reliable weapon function.

OICW Fuze + Payload Volume



NL Agent over 2X current amount.

Incapacitation area maximized

More effective over harsher atmospheric conditions

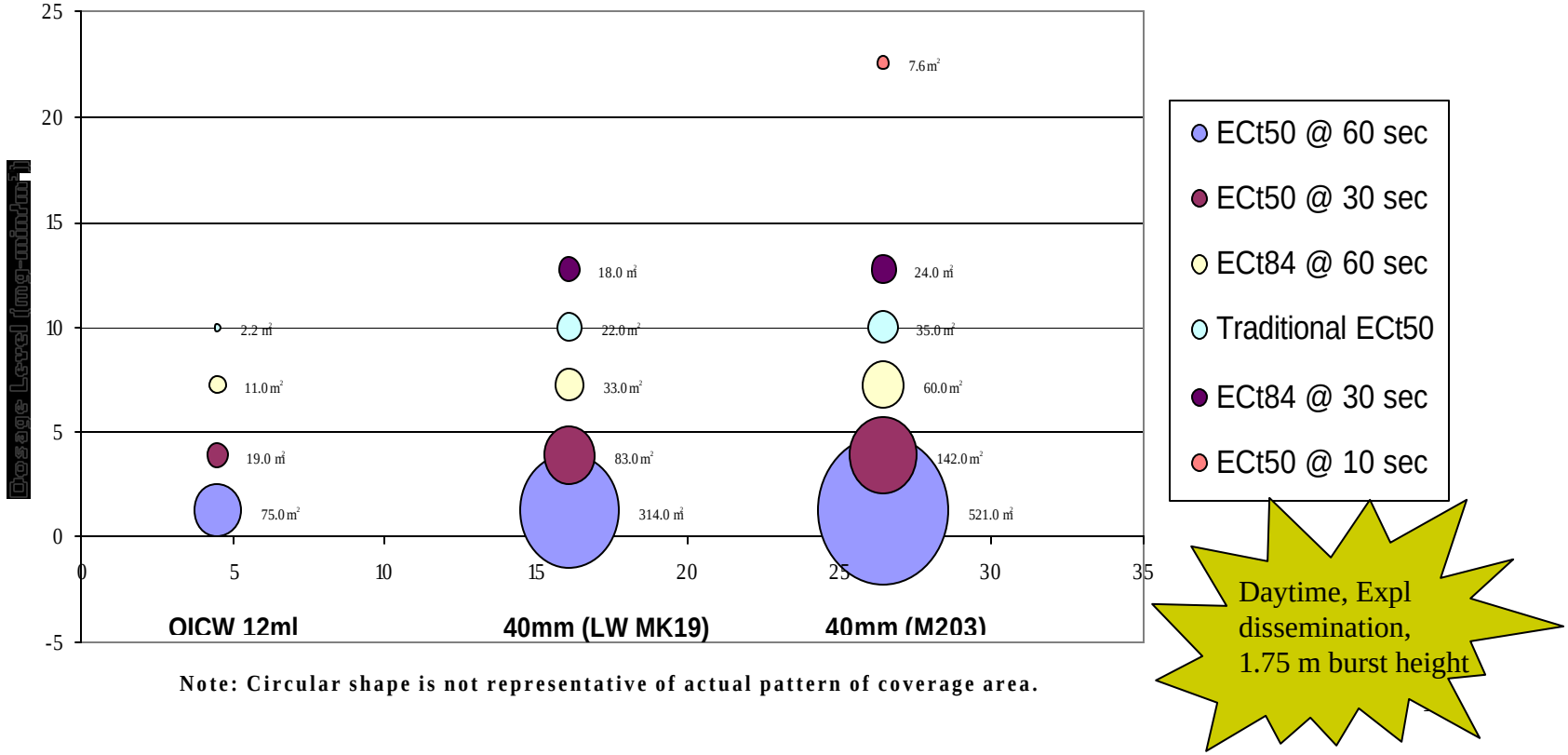
Model Inputs – Munition Configurations

Army was tasked to expedite a rapid scalability analysis of a NL 40 mm munition in addition to the 20mm NLAB OICW munition - Completed 10 May 01

Munition	OICW 20 mm		Mk19 40mm		M203 40 mm	
Tot Volume (ml)	12		42		69	
Dissemination	Expl	Pyro	Expl	Pyro	Expl	Pyro
CS (gms)	9.3	5.3	33.2	18.5	54.6	30.0
Airborne CS (gms)	4.5	3.2	16.1	11.1	26.5	18.0
Burn Time (sec)	Instant	5.3	Instant	11.5	Instant	30.0
CS density (gm/cc)	1.4 cast	1.1 pressed	1.4 cast	1.1 pressed	1.4 cast	1.1 pressed

Modeling Results

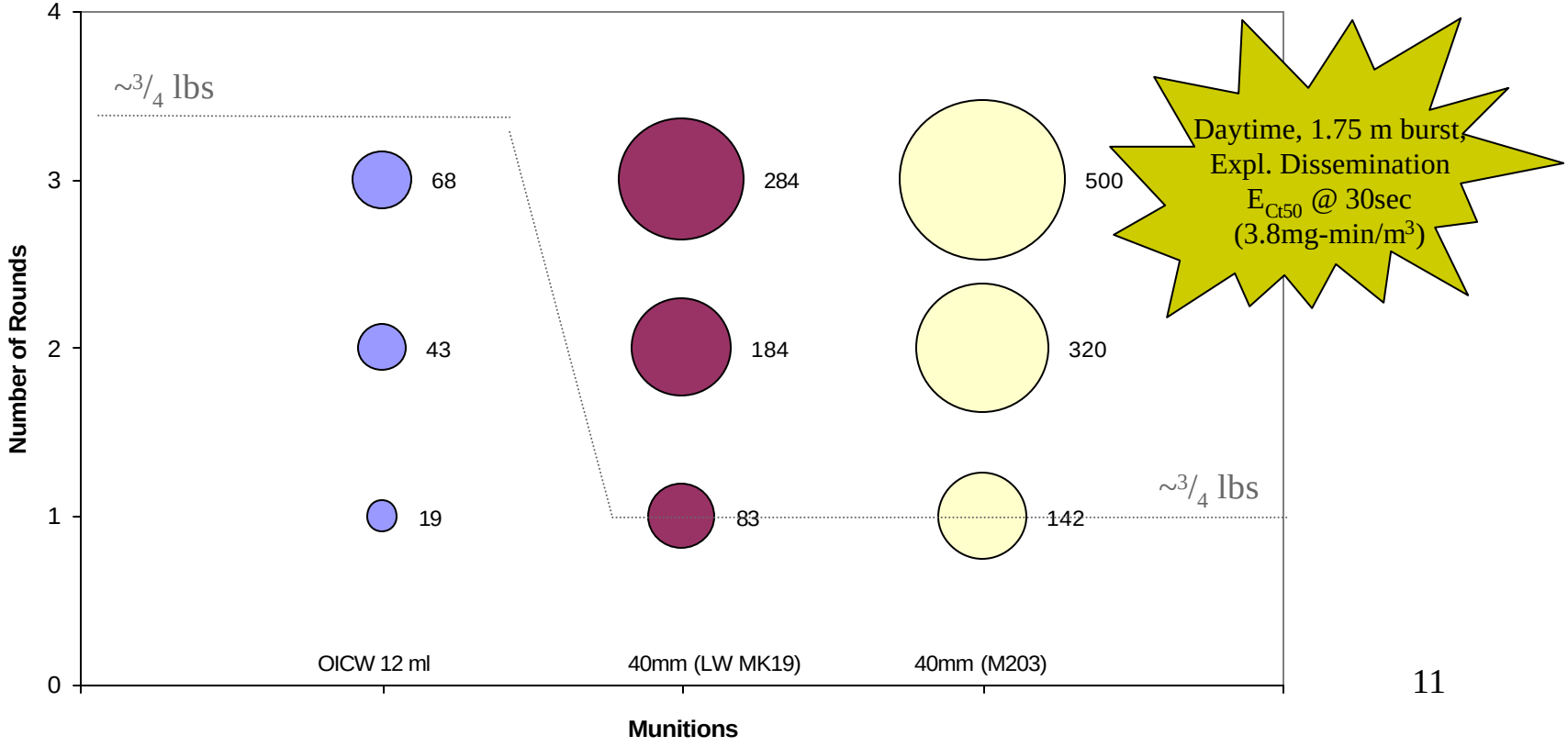
- Effective Dosage vs. Coverage Area:
  - **The numbers appearing to the right of each bubble are the corresponding coverage area in m^2. As expected, the coverage area decreases with increasing dosage level and decreasing time. The Traditional E_{Ct50} dosage (10mg-min/m^3), has historically been used as a 'worst case' and relates to highly motivated individuals who may be less susceptible to the effects of CS. The suitability of any of these rounds depends on the desired interpretation of incapacitation and effectiveness.**



Note: Circular shape is not representative of actual pattern of coverage area.

Modeling Results

- Multiple rounds vs. Coverage Area:
  - **As expected, multiple rounds increases the coverage area.**
  - **The 40mm grenades' coverage is greater than the OICW by a factor of 4-7, but this ignores their greater weights (~3.5x OICW).**
  - **On an equal-weight basis, differences are significantly less substantial.**



Human Effects

- The preliminary focus is on CS effect and overcoming the KE of projectile near target

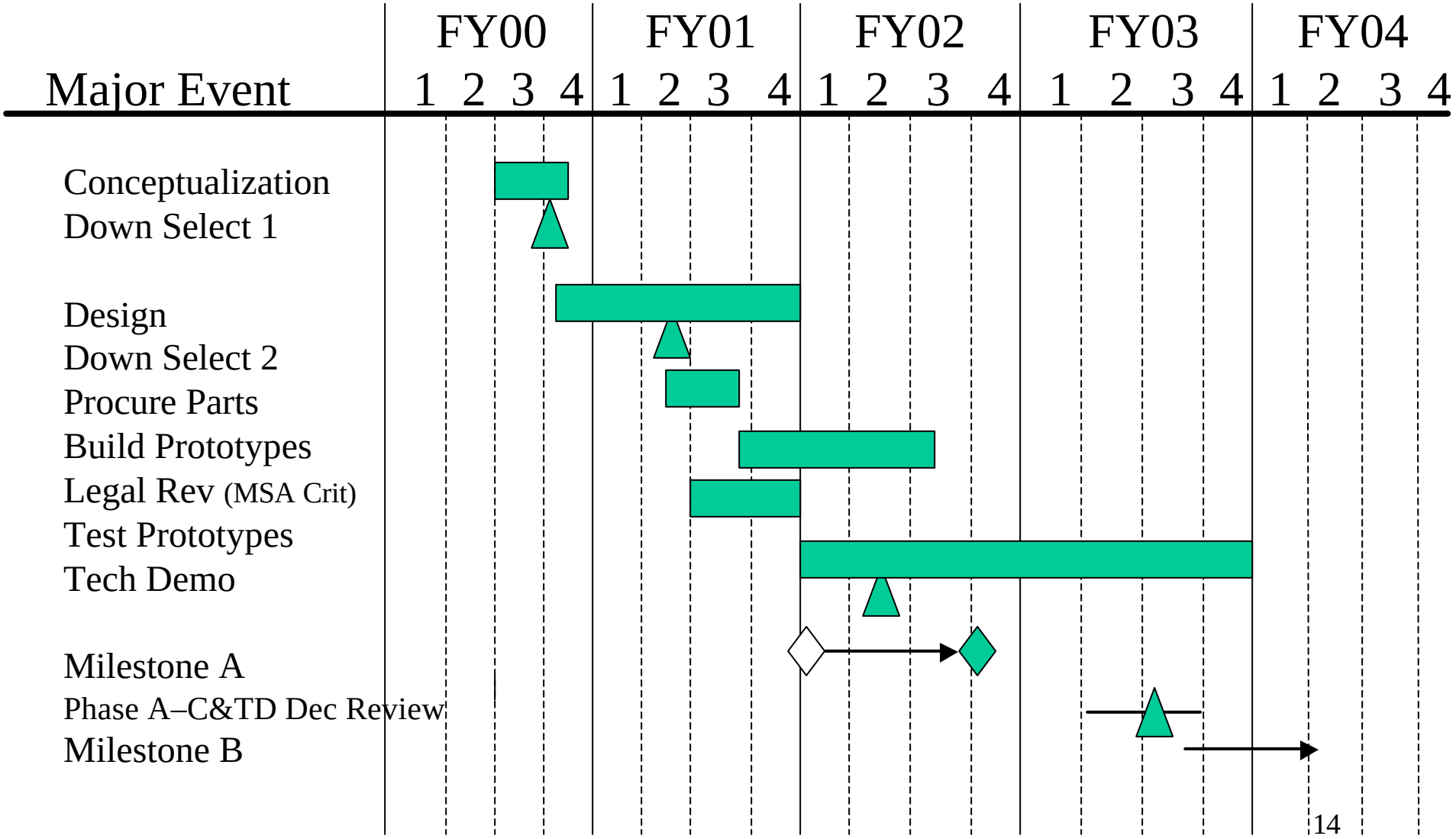
- Dosage can vary from .1 mg-min/m^3 to 10 mg-min/m^3 for 50^{th} %. Recommending additional study to investigate suitable concentration/ dosage metric
  - POC: L. Bickford – Edgewood Chemical Biological Center, SBCCOM

- Incapacitation mechanism: ocular (eyes), cutaneous (skin), and inhalation (breathing)
  - POC: Dr. Klauenberg – Human Effects Center of Excellence (HECOE), BAFB

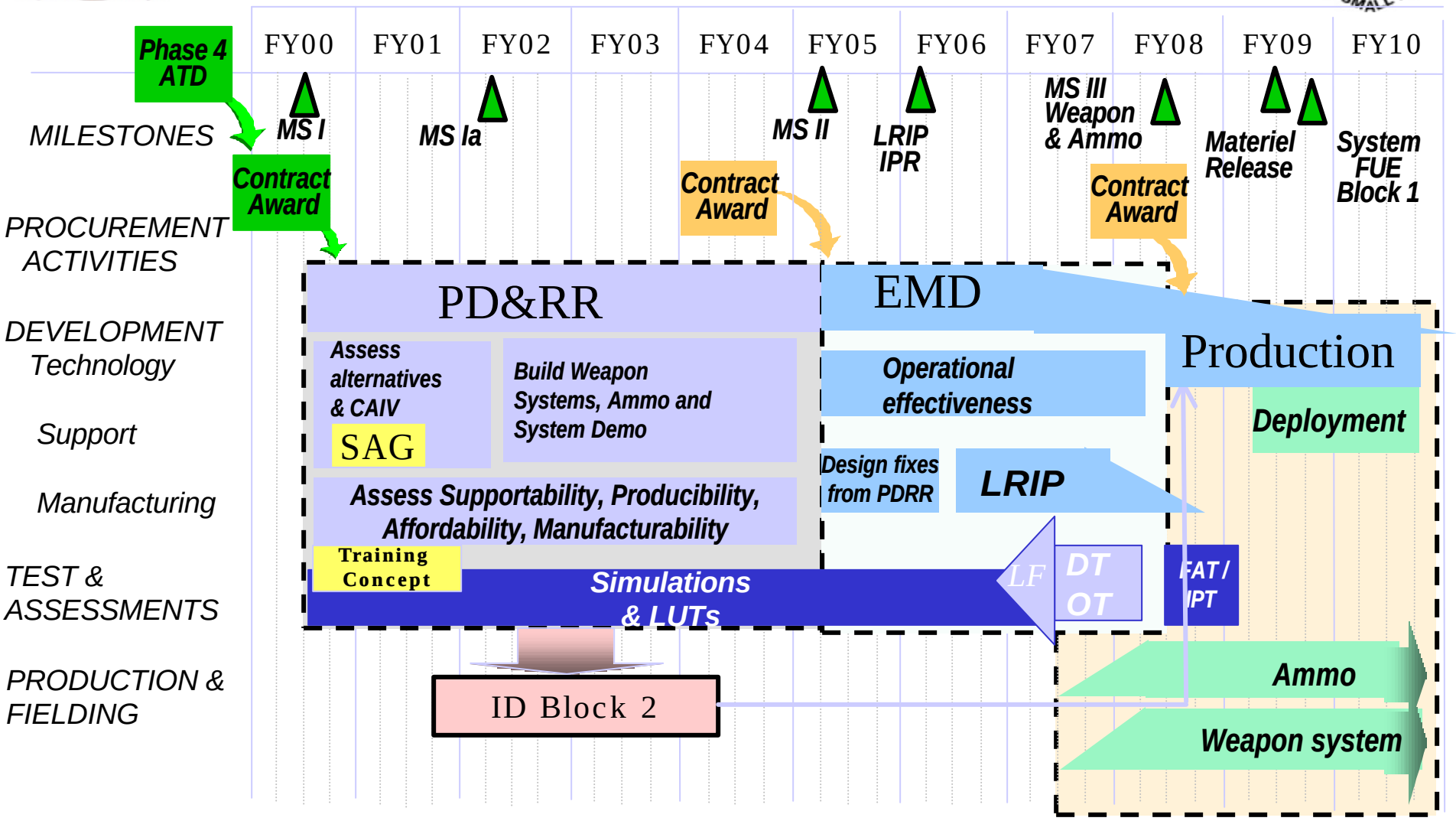
Program Strategy

Conceptualization of Projectiles for Liquids, Aerosols, Powders & Objects
Down Select to 2 Design Approaches per Payload Concept
Preliminary Designs
Critical Technology Tests
Exit Criteria for Pre-MS A
Conduct Design Reviews
Down Select to Most Promising Design per Concept
Prelim Legal Review
Fabricate Prototypes (validate M&S)
Conduct Developmental Tests using PD&RR Residual Hardware
Indep Assessment
Complete Milestone A
Select Representative Payloads
Phase A–Concept & Technology Devel Decision Review
Develop and Test Fire Prototypes in PD&RR Weapon
Initiate MS B
Transition to PM

Major Events Schedule



OICW Program Schedule



Program Documentation

Signed Program Documentation:

Document Title	Date Signed	Service Endorsements
OICW Approved ORD	24 Feb 00	
Pre-Phase 0 Exit Criteria	26 Apr 00	
OICW NL Munitions SOW		DRAFT
Army JAG Preliminary Legal Review	06 July 01	Coordinated w/ Navy JAG, Staff Judge Advocate to the USMC Cmdt

Security Classification Guidance

Document Title	Date Signed	Status
SCG for OICW	Aug 2000	Final
SCG for JNLW Program	Apr 1998	Final
SCG for JNLW Program	May 2001	Draft

M&S/Experimentation -Applied or Planned

Modeling & Simulation

Engineering:

•Frangible case – material selection, natural vs. induced frangibility (applied)

•Ballistic - PRODAS, 6DOF, deceleration rate, stability (applied/planned)

•CS effectiveness–expanded to include 40 mm. Inputs include: burst height, dosage, dissemination method, weather, salvos (applied)

•Gaussian plume models include: D2PC, VLSTRACK, and SEMCON

Experimentation

Technology Demonstration:

•Chamber testing - ECBC payload dissemination methods

•i.e. Explosive (applied), Propellant (planned)

•Ballistic testing- demonstrate energetic ignition & velocity reduction (applied)

•Material frangibility –dynamic testing w/ energetics (planned)

Program Accomplishments

- Received favorable Army JAG preliminary legal review – coordinated w/ USN and USMC JAG
- 20 mm NLAB OICW static and Mann barrel tests conducted
  - Initiation survivability
  - Separation velocities for projectile and lead shot
    - i.e. >557 fps[Alum – 18 gms], > 167 fps [Ballast/CS – 60 gms]
  - Dynamic Goal:< 100 fps[Alum – 20 gms], > 767 fps [Ballast/CS – 60 gms]
- Modeling performed for 20 mm & 40 mm delivery vehicles. Results include:
  - Effective areas estimated for 50^{th} & 84^{th} percentile dosage;
  - 60 Sec, 30 Sec & 10 Sec time windows
- CS chamber testing performed on 20 mm configuration
- Frangible windshield materials statically tested, interfaces established
- Contract awarded to Alliant Techsystems - 30 May 01
  - OICW Cartridges & Fuzes
  - Firing support and LAP services